was observed at 2,000 feet; the water, in each case, having been undisturbed for a month. Supposing these results not to be vitiated by convection, and assuming the mean temperature at the surface to be 50°, we have an increase of 29° in 2,000 feet, which is at the rate of 1° in 69 feet.

Mr. Symons has taken a series of observations at the depth of 1,000 feet in the Kentish Town well, with the view of determining whether the temperature changes. The instrument employed is a very large and delicate Phillips' maximum thermometer. The following is a list of the observations:—

Date of lowering.	Depth indicated. Feet.	Thermometer set at.	Date of raising.	Depth indicated. Feet.	Temperature. Fahr.
1874 —	1000	64·50	May 8	1007	66·82
,, May 8	1000	63·80	July 2	1009	(reading lost.
,, July 2	1000	63·20	July 28	1005	67·40
,, July 28	1000	65·10	Sept. 8	1004	67 51
,, Sept. 8	1000	65·80	Sept. 29	1004	67·43
,, Sept. 29	1000	65·81	Oct. 30	1006	67·68
,, Oct. 30	1000	63·40	Dec. 3	1006	67·52
,, Dec. 3	1000	63·80	Jan. 7	1009	67·63
1875 Jan. 7	1000	63·75	Feb. 1	1006	67·56
,, Feb. 1	1000	63·90	March 3	1005	67·58
,, March 3	1000	63·90	May 3	1006	67·62
,, May 3	1000	63·95	June 1	1005	67·49
,, June 1	1000	63·00	July 7	1005	67·53
,, July 7	1000	63·87	Aug. 3	1004	67·58
,, Aug. 3	1000	63·87	Sept. 10	1004	67·58
,, Sept. 10	1000	64·00	Oct. 2	1003	67·58
,, Oct. 2	1000	63·90	Oct. 19	1004	67·62
,, Oct. 19	1000	63·80	Nov. 1	1005	67·62
,, Nov. 1	1000	63·70	Dec. 1	Wire broke.	

The "depth indicated" is shown by a measuring wheel or pulley, over which the wire runs by which the thermometer is raised and lowered, as described, with a diagram, in the Report for 1869. The above table shows that there is always some stretching, real or apparent, in the interval between lowering the thermometer and raising it again. Recent observations by means of a fixed mark on the wire, have shown that the change is not, in the main, a permanent elongation, but an alternation of length. It is probably due in part to the greater tension which the wire is under in raising than in lowering, a circumstance which will cause a temporary difference of length variable with the rapidity of winding up; also in part to the circumstance that the wire is warmer when it has just left the water than when it is about to be let down. Some portion of the irregularity observed may be due to variations of temperature in that part of the well (210 feet) which contains air. The observations taken as a whole, show that any variations of temperature which occur in this well at the depth of 1,000 feet, are so small as to be comparable with the almost inevitable errors of observation. The observations will be continued at intervals of six months, with additional precautions, and with an excessively slow (specially constructed) non-registering thermometer, in addition to the maximum thermometer hitherto employed.

Through the kindness of the eminent geologist, M. Delesse, of the Ecole Normale at Paris, observations have been obtained from the coal-mines of Anzin, in the north of France. They were taken under the direction of M. Marsilly, chief engineer of these mines. Maximum thermometers of the protected Negretti pattern, were inserted in holes bored horizontally to the depth of ·6 or ·7 of a metre in the sides of shafts which were in process of sinking, and in which there was but little circulation of air. A quarter of an hour was allowed to elapse in each case, after the boring of the hole, before the thermometer was inserted, and the hole plugged. Four different shafts were tried. Those designated as Nos. I., II., III., were in the mine Chabaud La Tour; and No. IV. was in the mine Renard.

In Shaft I. observations were taken at eight different depths, commencing with the temperature 56½° F. at the depth of 38·5 metres, and ending with 67¾° F. at 200·5 metres.

In Shaft II. there were observations at four depths, commencing with 55° at 87·3 m., and ending with 63½° at 185 m.

In Shaft III. there were observations at three depths, commencing with 56° at 87·8 m., and ending with 62½° at 144 m.

These three shafts, all belonging to the same mine, were very wet, and the temperature of the air in them was 11° or 12° C. (52° or 54° F.).

In Shaft IV., which was very dry and had an air temperature of about 15° C. (59° F.), observations were taken at 6 depths, commencing with 70¾° F. at 21·2 m., and ending with 84° F. at 134·8 m.

The mean rates of increase deduced from these observations are:—

In Shaft	I.,	1° F. in	14·4 m.,	or in	47·2 feet.
,,	II.,	,,	11·5 m.,	,,	37·7 ,,
,,	III.,	,,	8·65 m.,	,,	28·4 ,,
,,	IV.,	,,	8·57 m.,	,,	28·1 ,,

The observer mentions that in Shaft II. there was at the depth of 90 m. a seam of coal in which heat was generated by oxydation; but no such remark is made with respect to any of the other shafts, although it is obvious that some disturbing cause has rendered the temperatures in Shaft IV. abnormally high. Possibly the heat generated in boring the holes for the thermometers in this shaft (which was dry) has vitiated the observations, the instruments employed being maximum thermometers. Two of the slow non-registering thermometers mentioned in last year's Report have been sent to M. Delesse, to be used for verification.

The slow-action thermometers are constructed on the following plan:—The bulb is cylindrical and very strong, and is surrounded by stearine or tallow, which fills up the space between it and a strong glass shield in which the thermometer is inclosed. The shield is not hermetically sealed (not being intended for protection against pressure), but is stopped at the bottom with a cork, so that the thermometer can be taken out and put in again if desired. Stearine and tallow were selected, after trials of several substances, including paraffin-wax, bees'-wax, glue, plaster of Paris, pounded glass, and cotton wool. The thermometers are inclosed in copper cases lined with india-rubber. When placed, without these cases, in water differing 10° from their own temperature, they take nearly half a minute to alter by one-tenth of a degree.

In concluding this Report, your Committee desire to express their regret at the losses which they have sustained by the deaths of Prof. Phillips, Sir Charles Lyell, and Col. Strange, of whose valuable services they have been deprived within the last three years.

OUR ASTRONOMICAL COLUMN

THE ROTATION OF SATURN ON HIS AXIS.—On December 7 Prof. Hall, of the Naval Observatory at Washington, observed a very white spot on the disc of Saturn, just below the ring. At 6h. 18m., Washington mean time, the spot was central, and it was watched from 22h. 40m. sidereal time, to 0h. 10m., as it moved across the disc. It was small, very well defined, and from 2″ to 3″ in diameter. A rough ephemeris of its motion was sent to various observers in the U.S., and the observations which have been received are as below. The second column gives the time when the spot was central.

		Washington. M.T. h. m.	Place.	Observer.	o − c
1876, Dec.	7	6 18	Washington	Hall	...
	10	6 11	Cambridge	A. G. Clark ...	− 8m
	—	6 3	Hartford	D. W. Edgecomb	0
	—	6 4	Poughkeepsie	M. Mitchell ...	− 1
	—	...	Albany	L. Boss	...
	13	5 47	Washington	Hall	0
	—	5 50	,,	Eastman	... 3
	—	5 38	Cambridge	A. G. Clark ...	+ 9

The column o − c gives the residuals when a rotation-time of 10h. 15m. is assumed. At Albany, on December 10, the spot was seen, but not until after passing the centre.

[It will be remarked that the time of rotation, supported by the above observations of a very definite spot, is in close agreement with the result obtained by Sir W. Herschel from noting the successive appearances of a belt during the winter of 1793-94,

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viz. 10h. 16m. 0·4s. Doubt has been occasionally expressed with regard to Sir W. Herschel's rotation-period from the uncertainty attaching to such observations, and the interesting confirmation of it just arrived at by the American observers will therefore be the more welcome. The Herschelian rotation for the planet globe of Saturn has been sometimes confounded with a rotation not depending upon observations, but calculated on Kepler's law for a satellite at an apparent mean distance equal to the semi-diameter of the middle of the ring; thus, Baily, in his "Astronomical Tables and Formulæ"—which were widely quoted for many years—has 10h. 29m. 17s. for time of rotation both of the globe and the ring.]

THE NEBULA IN THE PLEIADES.—Mr. Maxwell Hall, of Jamaica, communicates some observations of this nebula made on October 20, 1876, with a 4-inch Cooke equatorial, and power 55. "The nebula was 'bright,' according to Sir John Herschel's scale, and extended in a parabolical form at least 40′ from Merope, which was at the focus, while the axis of the figure was nearly S. of that star."

The difficulty of seeing with very large instruments a very faint nebulosity in close proximity to a bright star is strikingly illustrated by a remark made by Mr. Dreyer, observing with Lord Rosse; he states—"The Merope-nebula is never perceived with Lord Rosse's telescopes." So also D'Arrest sought for it in vain with the Copenhagen refractor, subsequently referring it to the class of which we are writing, which may be invisible in a great telescope but seen without difficulty in the finder. Vols. lviii. and lix. of *Astronomische Nachrichten* may be consulted for the earlier discussions as to the variability of this object.

VARIABLE STARS.—Prof. Schönfeld has published in *Vierteljahrsschrift der astronomischen Gesellschaft*, xi. Jahrgang, Heft 4, an ephemeris of the maxima and minima of most of the variable stars for 1877, including Algol, λ Tauri, S Cancri, δ Libræ, and U Coronæ Borealis, which have short periods. The max. of χ Cygni is dated February 6, and the min. on September 15; Mira Ceti, min. on July 23, max. on November 10.

Schmidt's star in Cygnus was red on January 7, and about equal in brightness to the star + 41° No. 4243 in the "Durchmusterung," but the difference of only 0·5m. between the catalogue brightness of this star and that of + 42° No. 4204, certainly did not represent their relative intensity of light on this evening. The variable might be estimated at 7·2m. by reference to the latter star.

METEORS OF JANUARY 7.—In the early part of this night a number of meteors were remarked near London, with unusually slow motion, particularly in the cases of several which equalled Jupiter in brightness. One at 10h. 32m. G.M.T. starting from near λ and μ Ursæ Majoris, appeared to receive a sudden check, and was stationary for two seconds 3° below α Canum Venaticorum, where it was nearly extinguished, but a faint portion left a train for several degrees further. It was not easy to judge of the radiant point owing to continual interruption from passing clouds, but it would probably be somewhere about the stars in Ursa Major above-named. Much lightning on this evening. The zodiacal light well seen as far as the principal stars of Aries.

THE MELBOURNE OBSERVATORY.—The Eleventh Report of the Board of Visitors of the Melbourne Observatory, with Mr. Ellery's Annual Report for the year ended 1876, June 20, has been received. In addition to the large reflectors, the Observatory now possesses an 8-inch equatorial, both instruments in excellent working order. With respect to the former, Mr. Ellery remarks that, although at present the mirrors retain their high reflecting polish exceedingly well, it is not to be overlooked that the time must arrive when they will require to be repolished, and in anticipation of this eventuality, which may occur sooner than is now looked for, he intends to devote time during the ensuing year to practice in grinding and polishing large surfaces. Out of about 150 nights during the year to which the report applies, which were more or less fit for observing with the reflector, forty were solely occupied with visitors. The astronomical work accomplished includes the examination, measurement, and sketching of seventy of the nebulæ and clusters of Sir John Herschel's southern work, of which the greater number have been drawn and described in a manner suitable for publication. Mr. Ellery adds:—"The result of these observations indicates that several of the nebulæ are considerably changed, while others appear so completely altered as to be scarcely recognisable, save by their position with respect to adjacent stars. The nebula about η Argus have been compared with a drawing made in March, 1875, but no decided changes were detected. The weather was so far unfavourable at Melbourne for certain classes of observations that out of ninety conjunctions of Saturn's satellites only ten could be observed. No material change in the regular work of the Observatory is contemplated during the year following the conclusion of the report. Observations with the transit-circle would be continued assiduously as in previous years, the Government Astronomer regarding this as the fundamental work of the establishment, which has already given it a reputation in the world, and he quotes in proof of this the opinion expressed by Sir George Airy, that the Melbourne Observatory had produced "the best catalogue of stars of the southern hemisphere ever published." The revision of Sir John Herschel's figured nebulæ will also be continued, with occasional planetary work, as drawings of Mars and Jupiter, observations of conjunctions of Saturn's satellites, &c.

The early publication of results obtained with the great reflector is strongly urged by Mr. Ellery, and all astronomers will concur in his representations upon this point. Difficulties, no doubt, must exist in giving such results to the astronomical world in a perfectly satisfactory manner; nevertheless, Mr. Ellery thinks if a plan he proposes is approved, these difficulties may be surmounted, and all the completed work with the reflector may be forthwith published. We can only express the hope that work of such great interest, and which may so greatly add to the reputation of the Melbourne Observatory, will soon be in the hands of the public. The importance of early publications of astronomical work in these days can hardly be exaggerated.

METEOROLOGICAL NOTES

NEW DAILY WEATHER MAP.—We hail with the greatest satisfaction the appearance, on New Year's Day, of the first number of a daily international weather-map issued by the Austrian Meteorological Institute. It embraces nearly the whole of Europe, and supplies a want not met by any existing weather-maps, in representing the weather of Central and part of Southern Europe, with a satisfactory fulness such as the meteorology of this important region demands in the development of this branch of the science. In addition to the invaluable material this publication will lay before us from day to day relating to thunderstorms, the summer rains, and the falls of hail and snow of Central Europe, it will also furnish data absolutely indispensable in investigating the causes which determine the course and the rate of progress of the storms of North-western Europe. Indeed, in this respect, and consequently in the prognosis of British storms, the Austrian empire is, of all countries which lie eastwards of Great Britain, second in importance only to Lapland and the north of Scandinavia.

LOW TEMPERATURES.—During recent weeks some remarkably low temperatures have been recorded in various countries. During a heavy storm which occurred on December 17 over

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